

SUPPORT FOR THE AMENDMENTS

Claims 1-11 and 16-24 are amended to use wording and structure consistent with U.S. patent law practice and to eliminate multiple dependencies.

Support for the amendment of Claim 7 is found on page 15, line 4, in the specification.

Claims 12-15 and 25-28 are herein canceled. Patent protection for the subject matter of these claims will be sought in two divisional applications to be filed during the pendency of the above-identified application.

No new matter is added to this application by entry of this amendment.

Upon entry of this amendment, Claims 1-11 and 16-24 are active.

REMARKS/ARGUMENTS

The claimed invention is directed to a carbon fiber bundle useful as a reinforcing material for thermoplastic resins. A carbon fiber bundle having good interfacial adhesion with poly-olefin based resins, especially polypropylene is sought.

The claimed invention addresses this problem by providing the sized plurality of single carbon fibers as described in Claim 1 and claims dependent thereon. No such carbon fiber bundle is disclosed or suggested in the references cited in the Official Action dated April 2, 2009.

Applicants have described the sizing material according to the claimed invention beginning on page 14 and bridging to page 15, as follows:

In the present invention, the carbon fiber bundle is sized with a sizing agent comprising:

 a polymer having a main chain formed of carbon-carbon bonds, containing an acid group in at least a part of side chains or at least a part of main chain ends, and representing an acid value of 23 to 120 mgKOH/g as measured in accordance with ASTM D1386; or

a polymer having a main chain formed of carbon-carbon bonds, containing at least either of an epoxy group and an ester group in at least a part of side chains or at least a part of main chain ends.

Applicants point out that the sizing polymer according to the claimed invention has a structure wherein the main chain is carbon-carbon chain with no heteroatoms included in the main chain. Acid groups, epoxy groups and ester groups are present on side chain groups or the ends of the main chain. Applicants have identified acid modified polypropylene as a specific and preferred example of the claimed sizing agent and described the effects of the specific structural components as follows (page 16, lines 9-17):

The acid modified polypropylene resin (compound a1), which is an essential component of the sizing agent represented by the above-described (i), is the component to act as an efficient coupling agent, which the acidic group in the molecule boost the interaction with the single fiber surface of the carbon fiber bundle or the pre-sizing agent deposited to the carbon fiber bundle surface when the complex of the carbon fiber bundles and polyolefin-based resin or other such matrix resin is formed, while the polypropylene chain in the skeleton causes strong bonds to form with the matrix resin as a result of the molecules being entangled together.

The rejection of Claims 1, 2 and 10 under 35 U.S.C. 102(b) over Hirai et al. (U.S. 5,227,238) is respectfully traversed.

Hirai describes carbon fiber filaments bundled by a sizing agent (Abstract). The Office has cited Col. 4, lines 7-21 of Hirai and states (Official Action dated April 2, 2009, page 3, lines 13-16):

As such examiner equates the resins as described by Hirai et al. to be equivalent to a polymer having a main chain formed of carbon-carbon bonds and containing at least either of an epoxy group and an ester group in at least part of side chains or at least a part of main chain ends.

Applicants respectfully disagree with the Examiner's interpretation of the Hirai description. A review of the structures listed in Col. 4, lines 7-21, reveals that none of the resins described are based on carbon-carbon backbones which are modified to have terminal or side chain acid groups with an acid value of 23 to 120 mg KOH/g or carbon-carbon

backbones which are modified to have terminal or side chain epoxy or ester groups.

Applicants also note that Hirai, in Col. 7, lines 41-50, does not disclose or suggest a sizing agent having a polymer backbone of carbon-carbon bonds.

Regarding Claim 2, Applicants point out that nowhere does Hirai disclose or suggest the specific combination of an epoxy presize followed by a size treatment according to Claim 1.

Applicants respectfully submit that a proper finding of anticipation requires that “[e]very element of the claimed invention ... be literally present, arranged as in the claim. *Perkin-Elmer Corp.*, 732 F.2d at 894, 221 USPQ at 673; *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771-72, 218 USPQ 781, 789 (Fed. Cir. 1983), *cert. denied*, 465 U.S. 1026 [224 USPQ 520] (1984). The identical invention must be described in as complete detail in the reference as is described in the claimed invention.

In view of the above, Applicants respectfully submit that the cited reference does not disclose or suggest every element of the claimed invention and therefore Hirai cannot anticipate or render the claimed invention obvious. Withdrawal of the rejection of Claims 1, 2 and 10 under 35 U.S.C. 102(b) over Hirai is respectfully requested.

The rejection of Claims 3-6, 9, 17, 18, 20 and 22 under 35 U.S.C. 103(a) over Hirai in view of Hasegawa et al.(JP 06-107442) is respectfully traversed.

Claims 3-6, 9, 17, 18, 20 and 22 all depend directly or indirectly from Claim 1. The deficiency of the primary reference to anticipate or render the invention described in Claim 1 obvious is described above. The Office has acknowledged that Hirai does not disclose “at least 35% of an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less and an acid value of 23 to 120 mg KOH/g (Official Action dated April 2, 2009, page 4, lines 22-25). Hasegawa is cited to cure this deficiency.

Hasegawa describes a polypropylene based sizing agent for inorganic fibers including glass fiber, carbon fiber, alumina fiber and ceramic fiber [0022]. Nowhere does this reference disclose or suggest a specific acid value for the sizing agent and nowhere is a relationship between acid value and sizing performance for a carbon fiber bundle disclosed or suggested. The Office has acknowledged this deficiency (Official Action dated April 2, 2009, page 5, lines 17-18). However, the Office alleges (Official Action dated April 2, 2009, page 6, lines 4-6):

. . . that one of ordinary skill in the art would have been easily motivated by the teaching to provide a sizing agent having an acid value as claimed by applicant.

Applicants respectfully note that neither cited reference discloses or suggests a relationship between carbon fiber bundle sizing performance and acid value.

Applicants respectfully call the Examiner's attention to the following excerpt from the Office's own discussion of "**Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.***"

"The rationale to support a conclusion that the claim would have been obvious is that **all the claimed elements were known in the prior art** and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art at the time of the invention. **“[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.”** If any of these findings cannot be made, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art," (Federal Register, Vol. 72, No. 195, page 57529) (References omitted)(Bold added)

Applicants respectfully submit that neither cited reference discloses or suggests an acid modified polypropylene resin having a weight average molecular weight of 45,000 or

less and an acid value of 23 to 120 mg KOH/g. Therefore, Applicants respectfully submit that all the claimed elements are not described in the cited combination of references.

Moreover, in a Precedential Opinion rendered by the Board of Patent Appeals and Interferences in *Ex parte Whalen II* (Appeal 2007-4423, Application 10/281,142) on July 23, 2008, the Board stated:

“The KSR Court noted that obviousness cannot be proven merely by showing that the elements of a claimed device were known in the prior art; it must be shown that those of ordinary skill in the art would have had some “apparent reason to combine the known elements in the fashion claimed.””

“The Examiner has not persuasively explained why a person of ordinary skill in the art would have had a reason to modify the compositions taught by Evans, Greff 767, or Taki in a way that would result in the compositions defined by the claims on appeal. Therefore, The Examiner has not made out a prima facie case of obviousness under 35 U.S.C. § 103.”

Applicants further submit that only in view of the claimed invention would one be directed to the claimed acid value.

When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than hindsight gleaned from the invention itself. *Interconnect Planning Corp.* 774 F.2d, 1143, 227 USPQ 551.

Something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co.* 730 F.2d 1452, 1462, 221 USPQ 481, 488 (Fed. Cir. 1984)

Applicants respectfully submit that only in hindsight, in view of the claimed invention, would one of ordinary skill in the art combine the cited references and identify the claimed acid value. The Office has not provided any reasonable explanation of how or why one of ordinary skill in the art would have combined the cited references to obtain the claimed invention, at the time of the present invention.

In addition, Applicants have shown the importance of the acid value range in the examples of Tables 4, 5, 6 and 7. Example 7 of Table 6 and Comparative Example 1 of Table 7 differ in that the acid value of the comparative example is not in the claimed range (see Table 3, sizing agent G). The measured performance properties of the invention example and the comparative example are shown in the following Table.

	Invention Example 7	Comparative Example 1
Tensile Strength at Break (MPa)	100	67
Bending Strength (MPa)	140	97
Bending Elastic Modulus (MPa)	7400	6800
Izod Strength (1/8" notch) (J/m)	75	67
Izod Strength (1/8" reverse notch)(J/m)	240	190

In all the strength measurements, the example according to the claimed invention shows significantly improved performance. The cited references neither disclose nor suggest such improvement.

In view of all of the above, Applicants submit that the cited reference combination cannot render the claimed invention obvious and withdrawal of the rejection of Claims 3-6, 9, 17, 18, 20 and 22 under 35 U.S.C. 103(a) over Hirai in view of Hasegawa is respectfully requested.

The rejection of Claims 7, 19 and 23 under 35 U.S.C. 103(a) over Hirai in view of Hasegawa and further in view of Rieux et al. (U.S. 3,806,489) is respectfully traversed.

Claims 7, 19 and 23 all directly or indirectly depend from Claim 1.

The Office has acknowledged that the primary references do not teach a sizing agent which comprises at least 40 wt% of a copolymer (compound c) obtained by copolymerizing

ethylene or propylene and an epoxy-containing monomer (Official Action dated April 2, 2009, page 8, lines 1-4). Rieux is cited for this purpose.

Rieux describes composite materials employing carbon having a surface associated with a continuous phase or matrix. The Office has cited this reference in Cols. 2 and 5 and provided examples of epoxy resins of the polyester type, but nowhere does Rieux disclose or suggest a copolymer obtained by copolymerizing ethylene or propylene and an epoxy-containing monomer.

The cited combination of references does not teach all the claimed limitations and according to the KSR guidelines above, a conclusion of obviousness cannot be supported. Accordingly, withdrawal of the rejection of Claims 7, 19 and 23 under 35 U.S.C. 103(a) over Hirai in view of Hasegawa and further in view of Rieux is respectfully requested.

The rejection of Claims 11 and 24 under 35 U.S.C. 103(a) over Hirai in view of Hasegawa and further in view of Rieux [Sugiura et al. (JP 2004-011030)] is respectfully traversed.

Claims 11 and 24 both depend indirectly from Claim 1 and include all the description therein. The deficiency of the primary reference(s) to render Claim 1 obvious is described above. Sugiura fails to cure this deficiency and therefore the cited combination of references cannot render Claims 11 and 24 obvious. Withdrawal of the rejection of Claims 11 and 24 under 35 U.S.C. 103(a) over Hirai in view of Hasegawa and further in view of Rieux [Sugiura et al.] is respectfully requested.

The rejection of Claims 8, 16 and 22 under 35 U.S.C. 103(a) over Hirai in view of Ikedo et al. (U.S. 6,569,523) is respectfully traversed.

Ikedo describes a carbon fiber bundle having specific size and structural properties and neither discloses nor suggests the sizing composition according to the claimed invention. Claims 8, 16 and 22 all depend directly or indirectly from Claim 1. As the cited secondary

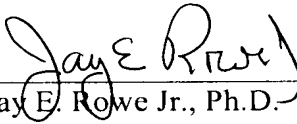
Application No. 10/566,473
Reply to Office Action of April 2, 2009

reference neither discloses nor suggests the sizing composition according to the claimed invention, it cannot cure the deficiencies of the primary reference described above in this paper. Accordingly, the cited combination of references cannot render Claims 8, 16 and 22 obvious and withdrawal of the rejection of Claims 8, 16 and 22 under 35 U.S.C. 103(a) over Hirai in view of Ikeda is respectfully requested.

Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

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